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EXAMINER

VALENTINE, JAMI M

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/529,851	Applicant(s) SUEMITSU ET AL.	
	Examiner JAMI M. VALENTINE	Art Unit 2894	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04 March 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1 and 3-28 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1 and 3-28 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 March 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Status of the Application

1. Acknowledgement is made of the amendment received 3/4/09. **Claims 1 and 3-28** are pending in this application. Claims 1, 4, 6, 8, 10-12, 19-21, 23 and 25 were amended and claims 26-28 were newly presented in the amendment received 3/4/09.

Claim Objections

2. The examiner notes that Claim 9 recites "said sidewall insulating film" however the previously antecedent "sidewall insulating film" was amended to "insulating sidewall". While all other dependent claims were accordingly amended, claim 9 was not. It appears that this is a typographical oversight.

Claim Rejections - 35 USC § 102

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. **Claims 1, 3, 5- 6 and 11-16** are rejected under 35 U.S.C. 102(b) as being anticipated by Gallagher et al. (US Patent No 5,650,958) hereinafter referred to as Gallagher.

5. Per **Claim 1** Gallagher (e.g. figure 8D) discloses a magnetic memory device, including

- a substrate;(9)
- a lower portion structure (including (12), (14), (16) and (18)) provided on or above said substrate as a portion of a magnetic element; said lower portion structure of said magnetic element comprising a first magnetic film (e.g. (14) or (18))
- an upper portion structure (including (32) (34) and (90)) provided on said lower portion

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structure of said magnetic element, said upper portion structure of said magnetic element comprising a second magnetic film (32)

- an insulating sidewall (90) provided to surround said upper portion structure of said magnetic element
- wherein the lower portion structure has an outer circumference that is the same as an outer circumference of a bottom of the sidewall. (e.g. fig 8D)

6. Per **Claim 3** Gallagher (figure 8D) discloses the device of claim 1, including where said lower portion structure of said magnetic element further comprises a conductive portion (12), the first magnetic film (e.g. (14) or (18)) being provided on or above said conductive portion, and said upper portion structure of said magnetic element comprises an insulating film (20), the second magnetic film (32) being provided on said insulating film (20)

7. Per **Claim 5** Gallagher discloses the device of claim 1, including where said upper portion structure of said magnetic element comprises a conductive film (34) formed on said second magnetic film (32)

8. Per **Claim 6** Gallagher discloses the device of claim 1, including where a plane shape of said upper portion structure of said magnetic element is a rectangle. (column 11 lines 65-67)

9. Per **Claim 11** Gallagher discloses the device of claim 1, including where said sidewall (40) comprises at least one of silicon oxide, silicon nitride, aluminum oxide, and aluminum nitride. (column 5 lines 8-9)

10. Per **Claim 12** Gallagher (figures 8A-H) discloses method of manufacturing a magnetic memory device, including

- forming a multi-layer film included in a magnetic element on or above a

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substrate; (column 9 lines 34-36, see figure 8A)

- etching said multi-layer film into a predetermined pattern up to a predetermined depth, to form an upper portion structure of said magnetic element; (column 10 lines 1-14, see figure 8B-C)
- forming a sidewall insulating film to surround said upper portion structure of said magnetic element; (column 10 lines 23-26, see figure 8D)
- etching a remaining portion of the multi-layer film by using the sidewall insulting film and said upper portion structure of said magnetic element as a mask to form a lower portion structure of the magnetic element. (column 10 lines 23-26, see figure 8D)

11. Per **Claim 13** Gallagher discloses the device of claim 12, including where forming a multi-layer comprises:

- forming a conductive film (12) and a first magnetic layer (14) formed on or above said conductive film in a portion corresponding to said lower portion structure of said magnetic element;
- forming an insulting layer (20) and a second magnetic layer (32) formed on or above said insulting layer in a portion corresponding to said upper portion structure of said magnetic element.

12. Per **Claim 14** Gallagher discloses the device of claim 12, including where said etching said multi-layer film into a predetermined pattern, comprises: etching said multi-layer film into said predetermined pattern by using a physical etching. (Ar⁺ ion milling, column 10 lines 1-14)

13. Per **Claim 15** Gallagher discloses the device of claim 14, including where said physical

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etching is ion milling. (Ar+ ion milling, column 10 lines 1-14)

14. Per **Claim 16** Gallagher discloses the device of claim 12, including where forming a multi-layer comprises:

- forming a conductive film (12) in a portion corresponding to said lower portion structure of said magnetic element; and
- forming a first magnetic layer (18) an insulating layer (20) formed on or above said first magnetic layer; and a second magnetic layer (32) formed on or above said insulating layer in a portion corresponding to said upper portion structure of said magnetic element.

15. **Claims 1, 3-5, 8-14, 16, 19 and 21-25** are rejected under 35 U.S.C. 102(e) as being anticipated by Okazawa et al. (US Patent No 2002/0146851) hereinafter referred to as Okazawa.

16. Per **Claims 1 and 10-11** Okazawa (e.g. figure 2J) discloses a magnetic memory device, including

- a substrate (21)
- a lower portion structure (including (23') and (24')) provided on or above said substrate as a portion of a magnetic element; said lower portion structure of said magnetic element comprising a first magnetic film (24').
- an upper portion structure (including ((25'), (26') and (30'))) provided on said lower portion structure of said magnetic element, said upper portion structure of said magnetic element comprising a second magnetic film (26')
- a insulating sidewall ((31') silicon oxide, see [0057]) provided to surround said upper portion structure of said magnetic element

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- wherein the lower portion structure has an outer circumference that is the same as an outer circumference of a bottom of the sidewall. (e.g. fig 2J)

17. Per **Claim 3** Okazawa discloses the device of claim 1 including where the lower portion structure of said magnetic element further comprises a conductive portion (23'), the first magnetic film being provided on or above said conductive portion, (e.g. figure 2J) and said upper portion structure of said magnetic element comprises an insulating film (25'), the second magnetic film (26') being provided on said insulating film.

18. Per **Claim 4** Okazawa (e.g. figure 2J) discloses a magnetic memory device, including

- a substrate (21)
- a lower portion structure (23') provided on or above said substrate as a portion of a magnetic element; said lower portion structure of said magnetic element comprising a conductive portion (23')
- an upper portion structure (including (24'), (25'), (26') and (30')) provided on said lower portion structure of said magnetic element, said upper portion structure of said magnetic element comprising a first magnetic film (24'), and insulating film (25') formed on or above the first magnetic film (24'), and a second magnetic film (26') formed on or above the insulating film (25')
- a sidewall (31') provided to surround said upper portion structure of said first magnetic film (e.g. figure 2J)
- wherein the lower portion structure has an outer circumference that is the same as an outer circumference of a bottom of the sidewall. (e.g. fig 2J)

19. Per **Claim 5** Okazawa discloses the device of claim 1 including where the upper portion

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further comprises a conductive film (30') formed on said second magnetic film (26').

20. Per **Claim 8** Okazawa discloses the device of claim 1 including an interlayer insulating film ((33) and (34)) formed to cover said lower portion structure of said magnetic element, said sidewall, and said upper portion structure of said magnetic element,(figure 2K-L) said interlayer insulating film has a via-contact (see figure 2M-N) connected with said upper portion structure of said magnetic element, and said sidewall (Silicon Oxide, [0057] is formed of a material which has an etching selection ratio smaller than said interlayer insulating film ((34) is resist which has an etching selection ratio smaller than silicon oxide).

21. Per **Claim 9** Okazawa discloses the device of claim 1 including an interlayer insulating film ((33) and (34)) formed to cover said lower portion structure of said magnetic element, said sidewall, (figure 2K-L).

22. Per **Claim 12** Okazawa (figures 2A-J) discloses method of manufacturing a magnetic memory device, including

- forming a multi-layer film included in a magnetic element on or above a substrate; (figures 2A-C)
- etching said multi-layer film into a predetermined pattern up to a predetermined depth, to form an upper portion structure of said magnetic element; (figures 2D-E)
- forming a insulating sidewall ((31) and (32)) to surround said upper portion structure of said magnetic element; (figures 2F-G)
- etching a remaining portion of the multi-layer film by using the sidewall and said upper portion structure of said magnetic element as a mask to form a lower portion structure of the magnetic element. (figures 2H-J)

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23. Per **Claim 13** Okazawa discloses the method of claim 12, including where forming a multi-layer comprises:

- forming a conductive film (23') and a first magnetic layer (24') formed on or above said conductive film in a portion corresponding to said lower portion structure of said magnetic element; (see figure 2J)
- forming an insulating layer (25') and a second magnetic layer (26') formed on or above said insulating layer in a portion corresponding to said upper portion structure of said magnetic element. (see figure 2J)

24. Per **Claim 14** Okazawa discloses the method of claim 12, including where said etching said multi-layer film into a predetermined pattern, comprises: etching said multi-layer film into said predetermined pattern by using a physical etching. (etched using O₂ plasma [0055])

25. Per **Claim 16** Okazawa discloses the method of claim 12, including where forming a multi-layer comprises:

- forming a conductive film (23') in a portion corresponding to said lower portion structure of said magnetic element; (see figure 2J)
- forming a first magnetic layer (24') an insulating layer (25') formed on or above said first magnetic layer; and a second magnetic layer (26') formed on or above said insulating layer in a portion corresponding to said upper portion structure of said magnetic element. (see figure 2J)

26. Per **Claim 19** Okazawa discloses the method of claim 12, including forming an interlayer insulating film ((33) and (34)) to cover said lower portion structure of said magnetic element, said sidewall and said upper portion structure of said magnetic element. (figure 2K-L).

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27. Per **Claim 21** Okazawa discloses the device of claim 9 including where the sidewall (Silicon Oxide, [0057] is formed of a material which has an etching selection ratio smaller than said interlayer insulating film ((34) is resist which has an etching selection ratio smaller than silicon oxide).

28. Per **Claim 22** Okazawa discloses the method of claim 19 including forming a via hole (figures 2M-N) in said interlayer insulating film so as to be connected with said upper portion structure of said magnetic element by an etching method [0060].

29. Per **Claim 23** Okazawa discloses the method of claim 22 including where the sidewall (Silicon Oxide, [0057] is formed of a material which has an etching selection ratio smaller than said interlayer insulating film ((34) is resist which has an etching selection ratio smaller than silicon oxide).

30. Per **Claim 24** Okazawa discloses the device of claim 1 including a wiring layer (36) arranged to be in electrical contact with an upper surface of the upper portion (figure 2N)

31. Per **Claim 25** Okazawa discloses the method of claim 12 including the step of with the sidewall in place, forming a wiring layer (36) arranged to be in electrical contact with an upper surface of the upper portion (figure 2N).

Claim Rejections - 35 USC § 103

32. **Claims 26-28** are rejected under 35 U.S.C. 103(a) as being unpatentable over Okazawa

33. Per **Claims 26, 27 and 28**, Okazawa discloses the magnetic memory device of claims 1, 4 and 12, respectively.

34. Okazawa fails to teach where the sidewall has a curved surface.

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35. Notwithstanding, one of ordinary skill in the art would have been led to the recited dimensions (curved shape) through routine experimentation and optimization. Applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). See also MPEP 2144.04(IV) (B).

36. **Claim 7** is rejected under 35 U.S.C. 103(a) as being unpatentable over Gallagher in view of Bhattacharyya et al. (US Patent No 6,297,983).

37. Per **Claim 7**, Gallagher discloses the magnetic memory device of claim 1 including and upper and lower portions on a magnetic element.

38. Gallagher does not disclose where a distance d on a plane between an the outer circumference the top of the lower portion structure and an outer circumference of an top of the upper portion structure of said magnetic element has a relation of $0.01 \mu\text{m} \leq d \leq 0.2 \mu\text{m}$

39. Bhattacharyya teaches a magnetic memory device with an upper and lower portion including where a distance c on a plane between an the outer circumference the top of the lower portion structure and an outer circumference of an top of the upper portion structure of said

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magnetic element has a relation of $0.01 \mu\text{m} \leq d \leq 0.5 \mu\text{m}$. (see figure 6D below, and column 3 lines 62-65)

40. It would have been obvious for one having ordinary skill in the art at the time the invention was made to form the magnetic memory device such that the difference, d , in the outer diameters of the upper and lower portions of the device have the relation $0.01 \mu\text{m} \leq d \leq 0.5 \mu\text{m}$ as taught by Bhattacharyya for the device of Gallagher, in order to minimize the demagnetizing effects emanating from the edges of the magnetic layers in the device. (column 2 lines 61-63)

41. **Claim 17-18** are rejected under 35 U.S.C. 103(a) as being unpatentable over Gallagher in view of Yoshida et al. (US Patent No 4,566,941).

42. Per **Claim 17**, Gallagher discloses the magnetic memory device of claim 16 including the etching of the multilayer film.

43. Gallagher does not disclose where each of said etching of a remaining portion of said multi-layer film is carried out by using a physical and chemical etching

44. Yoshida teaches the etching of a multilayer film using reactive ion etching, which is both a physical and a chemical etching method. (column 7 lines 11-14)

45. It would have been obvious for one having ordinary skill in the art at the time the invention was made to using a physical and chemical etching method to etch the multilayer film as taught by Yoshida for the device of Gallagher, since reactive ion etching method offers the advantage that an object body can be subjected to anisotropic etching without destroying a thin insulation layer included in said object body. (column 7 lines 11-14)

46. Per **Claim 18**, in so far as definite, the claim is rejected over prior art as follows:
Gallagher discloses the magnetic memory device of claim 16 including the etching of the

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multilayer film.

47. Gallagher does not disclose where each of said etching of a remaining portion of said physical and chemical etching is a reactive ion etching.

48. Yoshida teaches the etching of a multilayer film using reactive ion etching, which is both a physical and a chemical etching method. (column 7 lines 11-14)

49. It would have been obvious for one having ordinary skill in the art at the time the invention was made to using a physical and chemical etching method to etch the multilayer film as taught by Yoshida for the device of Gallagher, since reactive ion etching method offers the advantage that an object body can be subjected to anisotropic etching without destroying a thin insulation layer included in said object body. (column 7 lines 11-14)

50. **Claim 20** is rejected under 35 U.S.C. 103(a) as being unpatentable over Okazawa in view of Tuttle (US Patent No 6,417,561).

51. Per **Claim 20**, Okazawa (figure 2J-M) teaches the device of claim 12, but does not teach the flattening said interlayer insulating film by a chemical mechanical polishing method or an etching-back method.

52. Tuttle teaches planarization of the top surface of an MRAM device by chemical mechanical polishing. (column 7 lines 51-55)

53. It would have been obvious for one having ordinary skill in the art at the time the invention was made to include an interlayer insulating film to cover the upper and lower portions structure of the magnetic element, as well as the sidewall insulating film, and to flatten the interlayer insulating film on said upper portion structure of said magnetic element by a chemical mechanical polishing method, where said sidewall insulating film is formed of a material which

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has a selection ratio in the chemical mechanical polishing method or the etching-back method smaller than said interlayer insulating film as taught by Okazawa and Tuttle in order provide a flat topography. Planarization of the uppermost layers of such devices was a well known technique at the time the invention was made.

Response to Arguments

54. Applicant's arguments filed 3/4/09 have been fully considered but they are not persuasive.

55. Applicant argues (page 16) that Gallagher's layer (90) is not a sidewall insulating film. This argument is not persuasive since Gallagher's layer (90) is insulating and it is on the sidewalls, as shown in figure 8D. The words of the claim must be given their plain meaning unless consistent with the specification.

56. Applicant argues (pages 16-17) that the device of Gallagher is not a magnetic memory because the cited figure shows an interim step in the manufacturing process. The examiner respectfully disagrees. The argument is not persuasive because the intermediate device of Gallagher does comprise sufficient structure to function as a magnetic memory.

57. Applicant argues page 18) that proving whether the device of Gallagher figure 8D can function as a memory device is problematic since no evidence has been proffered. This argument is not persuasive since the structure of Gallagher figure 8D is identical to the claimed structure. Hence, it inherently follows that the prior art structure can function in the same manner.

58. Applicant argues (pages 17-18) that Gallagher does not show that the lower portion structure has an outer circumference that is the same as an outer circumference of a bottom of the

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sidewall insulating film. This argument is not persuasive since figure 8D shows this feature.

MPEP 2121.04 states that pictures and drawings may be used to reject claims when the picture shows all the claimed structural features and how they are put together. Further, MPEP 2125 states that drawings and pictures can anticipate claims if they clearly show the structure which is claimed. While the drawing may not be to scale, there is no indication that parts that are drawn with identical widths should have anything other than an identical width. No measurements of the drawings were made.

59. While Applicant appreciates (page 19-20) that Figure 2J anticipates the claim limitations however, Applicant argues that Okazawa figure 2K does not disclose a completed device and that an intermediate step does not anticipate the claimed device. This argument is not persuasive, (see above).

Conclusion

60. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to JAMI M. VALENTINE whose telephone number is (571)272-9786. The examiner can normally be reached on Monday-Friday 9am-6pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kimberly Nguyen can be reached on (571) 272-2402. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/JMV/

/THANH V. PHAM/

Primary Examiner, Art Unit 2894